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Resource Manual for Implementing the NSPS Continuous Monitoring Regulations. Manual 3 - Procedures for Agency Evaluation of Continuous Monitor Data and Excess Emission Reports

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Prepared for

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RESOURCE MANUAL FOR IMPLEMENTING THE NSPS CONTINUOUS MONITORING REGULATIONS

Manual 3 - Procedures for Agency Evaluation of Continuous Monitor Data and Excess Emission Reports

Stationary Source Enforcement Series

EPA-340/1-78-005c
April 1978

U.S. ENVIRONMENTAL PROTECTION AGENCY
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16. ABSTRACT

Manual 3 - Procedures for Agency Evaluation of Continuous Monitor Data and Excess Emission Reports - is one of a series of four manuals that comprise the "Resource Manual for Implementing the NSPS Continuous Monitoring Regulations." The other manuals are:

Manual 1 - Source Selection and Location of Continuous Monitoring Systems

Manual 2 - Preliminary Activities for Continuous Monitoring System Certification (Installation, Notification and Performance Evaluations)

Manual 4 - Source Operating and Maintenance Procedures for Continuous Monitoring Systems

Manual 3 presents the NSPS regulations for data and reporting requirements for affected sources. The manual also discusses the use of various factors in converting data to units of standards. Examples are given to illustrate what must be reported and how to evaluate the contents of these reports.

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This report has been reviewed by the Division of Stationary Source Enforcement and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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A. INTRODUCTION

Manual 3, Procedures for Agency Evaluation of Continuous Monitor Data and Excess Emission Reports, of the "Resource Manual for Implementing the NSPS Continuous Monitoring Regulations" presents the NSPS regulations for data and reporting requirements for affected sources. The Manual also discusses the use of various factors in converting data to the units of the standards as they apply to three specific source categories, fossil fuel-fired steam generators, nitric acid facilities and sulfuric acid plants. One section of this Manual which agency personnel should find very beneficial in Section D, Evaluation of Quarterly Excess Emission Reports. Hypothetical and actual examples are used to illustrate what must be reported and how to evaluate the contents of the reports.

Manual 3 is one of a series that comprise the "Resource Manual". The other Manuals are:

Manual 1 Source Selection and Location of Continuous Monitoring Systems

Manual 2 Preliminary Continuous Monitoring System Certification Activities (Installation, Notification and Performance Evaluations)

Manual 4 Source Operating and Maintenance Procedures for Continuous Monitoring Systems

B. REGULATIONS

The data and report requirements placed upon the source are detailed in Part 60.7(b) and (c) of the New Source Performance Standards.

Records must be kept for 2 years for:

- ...any periods during which a continuous monitoring system or monitoring device is inoperative...
- ...including continuous monitoring system, monitoring device and performance testing measurements; all continuous monitoring system performance evaluations...

- ...all continuous monitoring system or monitoring system calibration checks...
- ...adjustments and maintenance performed on these systems or devices...
- ...and all other information required by this part recorded in a permanent form suitable for inspection...

This portion of 60.7(d) appears to be all-inclusive. However, there are several important limitations to keep in mind during evaluations or other contacts with the source.

Although there is no specific requirement on the timeliness or availability of data, a source must have the data in a "form suitable for inspection." A source is only required to convert strip charts or other records to the applicable averages (in the case of excess emissions, to units of the standard). Therefore, data needs to be inspected and converted only in conjunction with the filing of the quarterly report. A series of strip chart records from various monitors would almost certainly be a "permanent form suitable for inspection," although from these records alone (without supporting data), the inspector probably could not tell whether the source was operating within limits. On the other hand, a magnetic tape record would generally not be considered a "form suitable for inspection."

Second, the regulations do not require the source to maintain a readout device that is visible to the operator or the operator to use the monitoring system output directly to control the source. Neither realtime nor explicit use of monitoring data is required of the source at <u>any</u> time. However, since the monitoring system data will be used to determine whether the source is properly operating and maintaining its control equipment, it is to the source's advantage to make use of the realtime information available.

In addition, although realtime attention is not specifically required of the source, the source must be able to identify the deviation, magnitude, cause, and corrective action taken for all periods of excess emissions. In order to comply with these requirements, the source must have a procedure for keeping this information.

The following data should be available to the inspector on short notice:

- The daily zero and calibration check and adjustment log
- The monitor's maintenance log, containing the time and date of any malfunctions, the nature of the repair, and the time and date of return to service
- Source operating logs containing sufficient operating information to identify startups, shutdowns and malfunctions that might explain excess emissions, the nature and cause of these malfunctions, and the corrective action or preventive measures taken
- A copy of the most recent report, along with the original data records covering the reporting period

In summary a good set of records will contain the following:

- The raw data output (i.e., strip chart) (although not required) including:
  - A record of stack SO_2/NO_x ppm or opacity versus time, normal and abnormal operation (unless the monitor is shut off)
  - A record of calibrations
  - A record of malfunctions in the monitoring system in the form of instrument response
- Handwritten records, consisting of:
  - Any notes on the charts
  - Notebook-type records of troubleshooting, maintenance and adjustments
- Any emission test reports and monitor performance test reports

All other information, reports, statistical calculations, averages, etc., is derived from these records.

A source is required to file a quarterly report of excess emissions, monitoring system maintenance, or a negative report covering these items (see list of Quarterly Excess Emissions report requirements on page 4-16).

C. DATA CONVERSION TO UNITS OF STANDARDS

Conversion of monitoring data to the applicable units of the standard is, for most sources, straightforward. However, for fossil fuel-fired steam generators, nitric acid plants and sulfuric acid plants certain factors are required in the data conversion.

1. Gaseous Pollutants for Fossil Fuel-Fired Steam Generators

Under Part 60.45, the operator of a fossil fuel burning steam generator has the option to measure either oxygen or carbon dioxide to correct for the effects of variable amounts of excess air in the effluent.

Because of recent NSPS revisions and approval of alternate monitoring requirements (42FR5936 and 41FR44838, respectively), it is acceptable for fossil fuel steam generators monitoring gaseous pollutants to:

- Measure CO_2 after a flue gas desulfurization device if used. However, since reactions produce CO_2 in limestone scrubbing, a 1-percent increase in the F_c factor is required when this type of FGD device is used.
- Measure the pollutant and diluent O_2 on a consistent, wet or dry basis

An instantaneous monitoring system gas concentration can be converted to units of the standard in three steps. First, the output of the monitoring system is converted from watts or milliamperes into concentration (ppm, percent) using a prepared chart (Figure 3-1) or a calculation formula. The concentration then is multiplied by a unit conversion factor and the molecular weight to convert the ppm concentration to lb/dry scf or to gm/dry scm. The conversion factor is $2.59 \times 10^{-5} \times M$ for gm/dscm. The molecular weight (M) are 64.07 for SO_2 and 46.01 for NO_x (calculated as NO_2).

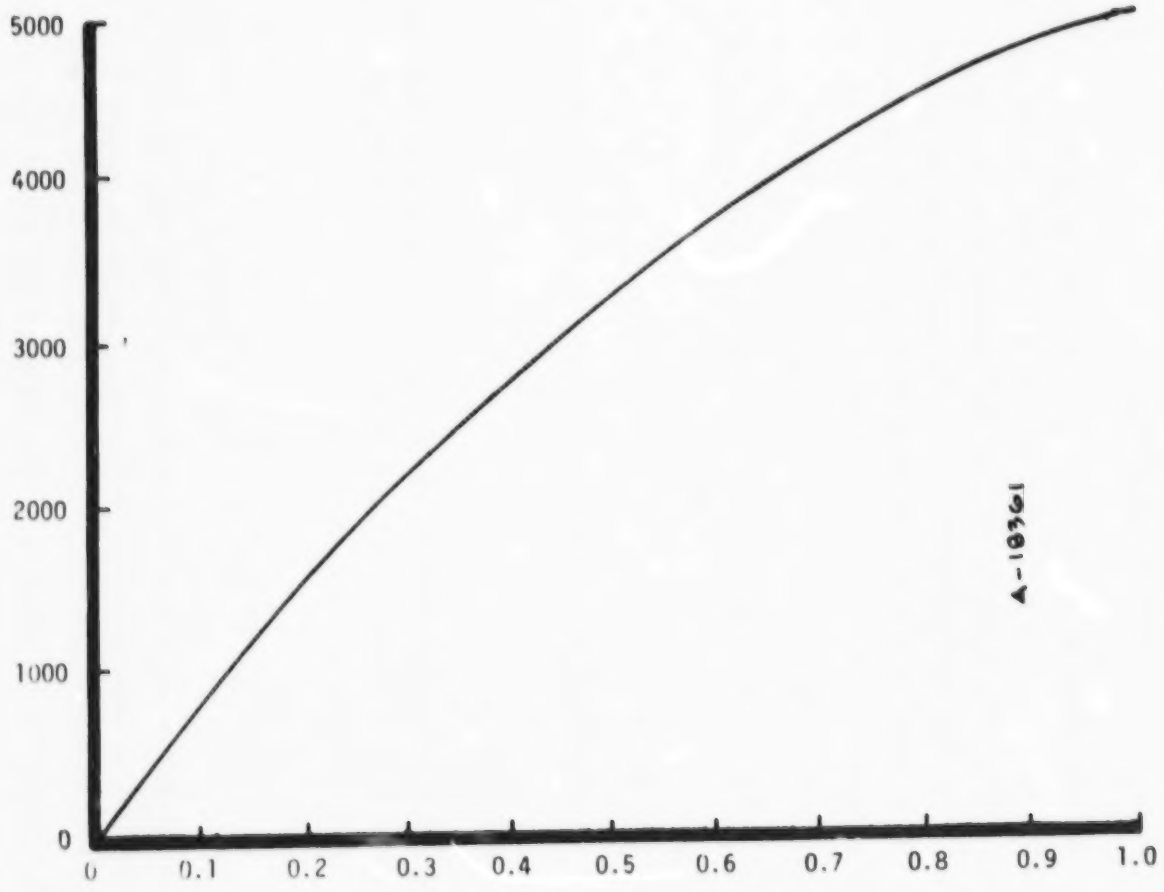

Figure 3-1. Typical continuous analyzer calibration chart.

Three formulas are used for diluent correction: one based on O_2 dry, one based on O_2 wet, and one based on CO_2. If the source operator chooses to monitor on a dry O_2 basis, both the O_2 and SO_2/NO_x must be measured with the monitoring system removing the moisture from the sample stream. The emission calculation formula is

$$E = CF \frac{20.9}{20.9 - \%O_2}$$

(where C is the concentration of NO_x or SO_2 calculated in gm/dscm (lb/dscf), as shown above, and F is a factor which relates the volume of flue gas to the heat input of fuel.) The F factor is computed according to the type of fuel burned. The source has the option of using "standard" F factor values (prescribed in the regulation) or computing their own factors based on actual chemical and physical analysis of each lot of coal.

To compute F on actual coal analysis, the formula is:

$$\text{(Metric) } F = \frac{227.(\%H) + 95.7\ (\%C) + 35.4\ (\%S) + 8.6(\%N) - 28.5(\%O)}{GCV}$$

where the GCV is the gross calorific value in calories/gram.

$$\text{(English) } F = \frac{10^6[3.64(\%H) + 1.53(\%C) + 0.57(\%S) + 0.14(\%N) - 0.46\ (\%O)]}{GCF}$$

where GCV is in Btu/lb.

If the source operator chooses to monitor on a wet basis, both the O_2 and pollutant must be measured without removing water from the gas stream. In this case, the emission calculation formula is

$$E = C_{ws}\ F_w\ \frac{20.9}{20.9\ (1 - B_{wo}) - \%O_{2ws}}$$

(where C_{ws} is the pollutant concentration at stack conditions and F_w is a factor representing a ratio of the volume of wet flue gases generated to the caloric value of the fuel combusted.) Here too, the source may use EPA calculated F_w factors or calculate a factor based on the actual fuel used.

To compute F_w using the actual fuel, the formula is

$$\text{(Metric) } F_w = \frac{347.4\%H + 95.7\%C + 35.4\%S + 8.6\%N - 28.5\%O + 13.4\%\ H_2O^1}{GCV_w}$$

$$\text{(English) } F_w = \frac{10^6[5.56\%H + 1.53\%C + 0.57\%S + 0.14\%N - 0.46\%O + 0.21\%\ H_2O^1]}{GCV_w}$$

If the source operator chooses to monitor carbon dioxide instead of oxygen to determine excess air, the emission calculation formula becomes:

$$E = CF_c \frac{100}{\%CO_2}$$

C is defined as for the previous emission computation. F_C may be obtained from standard EPA values for the appropriate fuel or computed based on the actual chemical and physical analysis of each lot of coal:

$$\text{(Metric units - dry basis only) } F_C = \frac{20.0\ (\%C)}{GCV}$$

$$\text{(English units - dry basis only) } F_C = \frac{321 \times 10^3\ (\%C)}{GCV}$$

Table 3-1 summarizes all F, F_e, and F_w factors determined by EPA to be representative of specific fuel types. Again, the source operator may use these values or calculate factors for his particular fuel.

If the procedure based on CO_2 is used, the SO_2 (or NO_x) and the CO_2 must be measured consistently (either wet or dry). In other words, both the pollutant and the CO_2 may be measured by an extractive monitoring system which removes the water vapor before both gases are measured (dry) or both gases may be measured either in situ or extractively without removing the water vapor (wet). The source may <u>not</u> measure one gas wet and the other dry.

The source should be asked which derivation of the F, F_C or F_w value is used for emission calculation. If the source calculates the factor from chemical analysis, he should have written procedures for determining which lot of coal is used at a given time, how the lots of coal are separated, and how to use the lot analysis results to compute F, F_C, or F_w. It would be useful to compare two or three coal analyses to determine the lot-to-lot

[1]This term may be omitted if $\%H + \%O_2$ includes the unavailable hydrogen and oxygen in the form of water.

TABLE 3-1. F, F_c, and F_w FACTORS FOR FOSSIL FUELS

Type of Fuel	Standard Values					
	F (Measuring O_2)		F_C (Measuring CO_2)		F_W (Measuring O_2 Wet)	
	dscf/ MBtu	dscm/ Mcal	dscf/ MBtu	dscf/ Mcal	wscf/ MBtu	wscm/ Mcal
Anthracite	10140	1.139	1980	0.222	10580	1.188
Bituminous	9820	1.103	1810	0.203	10680	1.200
Subbituminous	9320	1.103	1810	0.203	10680	1.200
Liquid	9220	1.036	1430	0.161	10360	1.164
Natural gas	8740	0.982	1040	0.117	10650	1.196
Propane	8740	0.982	1200	0.135	10240	1.150
Butane	8740	0.982	1260	0.142	10430	1.172

variability, and then to calculate the effect that these variations have on the F, F_C, and F_w factors and the emission calculation.

In most sources, the actual NO_x emission is a combination of nitric oxide (NO) and nitrogen dioxide (NO_2). In a power plant, for example, the emission may be 95-percent NO and 5-percent NO_2. NO and NO_2 are best measured by different means. Consequently, EPA states in the preamble to the October 6, 1975 amendment to the New Source Performance Standards that the source may determine the ratio of NO_2 to NO in the flue gases and then use a factor to adjust the continuous monitoring system emission data. The data can be adjusted if the factor is applied consistently to all data generated by the monitoring system thereafter.

Steam generators that emit NO_x levels that are 30-percent or more below the standard during performance testing are not required to monitor NO_x.

2. Gaseous Emissions for Nitric Acid Facilities

Unlike steam generators, nitric acid facilities have no standard F factors for translating concentrations into emission units. Part 60 (60.73) requires the emissions to be calculated for 3-hour averages made up of 1-hour averages calculated according to 60.13 (h).

During the performance testing of the monitoring system, or any subsequent source performance testing, the monitoring system should be operated concurrently with the reference method. After each set of data is validated and computed on a time comparable basis, the reference method readings are divided by the monitoring system readings to produce a ratio of volumetric ppm concentrations and the corresponding emission rate in kg/ton of nitric acid produced.

In a nitric acid plant without a decolorizer or "abater," the emission can be 90 to 95 percent NO_2 with the remainder NO. With a decolorizer or "abater," the ratio can vary from 90-percent NO_2 to 90 percent NO. Therefore since nitric acid plants are unable to meet the 10-percent NO_2 limitation, they are exempt from using the NO_x factor to adjust the continuous monitoring system emission data.

3. Gaseous Emissions for Sulfuric Acid Plants

The conversion factor for sulfuric acid plants is computed by determining the sulfur dioxide input to the converter once each 8-hour shift. The operator should record the volume percentage of SO_2 emitted, as indicated by the monitoring system. The conversion factor is given by:

$$CF = k \frac{1.000 - 0.015r}{r - s}$$

where CF = measured conversion factor (kg/metric ton per ppm, lb/short ton per ppm)

k = 0.0653 for metric units (kg/metric ton/ppm) or 0.1306 for English units (lb/short ton/ppm)

r = volume percentage of SO_2 input to the converter (appropriate corrections for air injection plants) as measured with the Reich test or other suitable method

s = volume (as measured with the CM) percentage of SO_2 in the exhaust gas during the determination of r

This factor is used to compute the emission averages:

E = CF x ppm SO_2 (in-stack as indicated by monitoring system)

Again, consistent inspection of the records will show whether the data are valid. By comparing the records of CF, r, and s for several days or weeks, any major deviations from approximate average values should be accounted for. Since most plants are built to operate most efficiently over small ranges of conditions, deviations of 10 to 20 percent or more should be matched by varying input feedstocks or products or some other substantive change in physical plant operation. Large changes in any of the measured values without corresponding changes in by-process parameter may indicate sloppy testing, a poor attitude, or faulty equipment. All of these possibilities should be investigated and the problem corrected as soon as possible.

D. EVALUATION OF QUARTERLY EXCESS EMISSION REPORTS

Quarterly Excess Emissions Reports are not an end in themselves. To be useful, the information they contain must be accurately interpreted. This

section lists the information required in a quarterly report, describes the summary reports from which this information is derived, and discusses how to review a quarterly report. To aid the observer in evaluating reports, a short checklist of direct questions is included. The answers to these questions will help to identify malfunctions in monitoring or control equipment or inaccuracies in reports. To illustrate the use of the checklist, three examples of typical reports are reviewed. Omissions -- both accidental and purposeful -- are pointed out, and specific corrective actions are suggested.

What Must be Reported

Any facility owner or operator required by the New Source Performance Standards to install, operate, and maintain a continuous emissions monitoring system is required to file a Quarterly Excess Emissions Report within 30 days of each calendar quarter. The report must contain the following information:

- The magnitude of excess emissions (as defined in applicable subparts)
- Conversion factors used in calculations
- The date and time of commencement and duration of each excess emission
- Identification of excess emissions that occur during periods of startups, shutdowns, and malfunctions of the affected facility
- The nature and course of any malfunction (if known)
- The corrective action taken or preventative measures adopted
- Dates and times that the continuous monitoring system was inoperative (except for zero and span checks)
- Repairs and adjustments (including zero and span) made to the monitoring system
- A report (if applicable) that no excess emissions have occurred, and that the monitoring system has been 100-percent operative and has not been repaired or adjusted

Often, the data required to report this information are recorded manually by an operator at the source. However, many sources use automated data systems to record the output of their continuous monitors. Table 3-2 shows a typed hourly report generated by one of these systems. This particular facility is a coal fired power plant monitoring opacity, sulfur dioxide, nitric oxide, and oxygen. The report indicates the 6-minute opacity measurements and show three periods when the monitor was apparently out of service (the three periods indicated as "ND" -- no data). The average indicated readings are corrected for zero and span offsets. This particular source has facilities to determine stack gas velocity and, thus, flowrate. By using the flowrate, the oxygen content, and the "F" factor for coal, the data system calculates the heat input rate as 1275.8 million Btu/hr. The SO_2 emission rate is calculated at 2.7 lb/MBtu, which exceeds the standard and is flagged with asterisks. The data percentage indicates the percentage of operating time during which the monitoring system collected data. This "emissions summary report," while answering some of the reporting requirements, must be accompanied by text which answers other questions, such as, what corrective action was taken for the excess emissions?

Table 3-3 shows a daily summary of emissions compiled from hourly reports like that in Table 3-2. Notice that only excess emissions and their duration are shown. For example, between noon and 3 p.m., two 6-minute opacity averages exceeded the limit and the average opacity during those two periods was 23.4 percent. During the same period, the SO_2 emissions were also high (1.65 lb/MMBtu) and the NO emissions were 0.84 l./MBtu. At the bottom of the report, excess emissions for the day are averaged and the emissions limit for the source is recorded. In this case, the source has exceeded its limit.

Table 3-4 shows a weekly summary report. The data represents an adequate reporting of the magnitude and duration of excess emissions as required by the regulations. However, such automatic summaries are not the complete picture in themselves. The source must also report malfunctions and adjustments made to the continuous monitoring system.

TABLE 3-2. EMISSIONS SUMMARY REPORT

Hourly Report 06/19/77				Time:	Plant #4 0900-1000
Opacity, %	16.699	2.1972	2.1972	2.1972	2.1972
6 min Avgs.	2.1972	2.1972	ND*	ND*	ND*
Hourly Avg.	OPAC		SO_2	NO	O_2
Indicated	--		767.35	539.13	9.5175
Zero Cal	17.138*		56.396	78.369*	0.7275
Span Cal	49.975		1289.7	1116.	8.9208
Corrected	2.7959		788.20	510.82	10.551
lb/MBtu	--		2.7189	0.8216*	--
lb/hr	--		3.4697	1.0542	--
Data %	70.		100.	100.	100.
Q SCFM 10E8	V-IND	V-AVG	DIA-FT		
481.40	38.741	45.157	20.		
Heat-MBtu/hr					
1275.8					

TABLE 3-3. EMISSIONS SUMMARY REPORT

Daily Report
06/16/77

Plant #4

Period	Opacity		SO_2		NO	
	6-Min. Int (Number)	Av. Mag (%)	8-Hr. Int (Number)	Av. Mag (lb/MBtu)	8-Hr. Int (Number)	Av. Mag (lb/MBtu)
0000-0300	0	--	1	1.24	0	--
0301-0600	0	--	0	--	0	--
0601-0900	0	--	0	--	0	--
0901-1200	1	21.6	1	1.32	1	0.92
1201-1500	2	24.4	1	1.65	1	0.84
1501-1800	5	25.6	1	1.63	1	0.75
1801-2100	1	22.7	0	--	0	--
2101-2400	0	--	0	--	0	--
Summary	9	24.3	4	1.46	3	0.84
Limits	0	20.0	0	1.20	0	0.70
Data, %		95.		95.		95.

TABLE 3-4. EMISSIONS SUMMARY REPORT

Weekly Report
06/16/77 - 06/22/77

Plant #4

Period	Opacity		SO_2		NO	
	6-Min. Int (Number)	Av. Mag (%)	8-Hr. Int (Number)	Av. Mag (lb/MBtu)	3-H4. Int (Number)	Av. Mag (lb/MBtu)
06/15	6	22.4	2	1.36	3	0.74
06/16	9	24.3	4	1.46	2	0.84
06/17	5	22.9	3	1.33	1	0.78
06/18	2	24.6	1	1.35	2	0.84
06/19	0	--	1	1.33	1	0.76
06/20	0	--	0	--	1	0.79
06/20	1	22.8	1	1.28	0	--
Summary	23	23.5	12	1.38	10	0.79

Table 3-5 shows a typical calibration check log as it might be printed by the data system. At this facility, normal zero and span checks are run each day on the second shift. More frequent checks of zero are made automatically by the monitor system. As was seen in the hourly report (Figure 3-1), on 6/19/77, at 9:45, the opacity monitor apparently had a malfunction that was noted by the data system, which typed out "ND" (no data) for the last three opacity averages for the 9 to 10 p.m. period. The maintenance man performed a zero check at 9:46, found a malfunction, and fixed it. The instrument was recalibrated and zeroed at about 10:15 a.m. The record of this in the maintenance log might read as follows:

> 09:45 a.m. Fuse blown on window blower on opacity monitor. Oiled motors, replaced fuse, cleaned window, and checked zero and span calibration. Return to service 10:20 a.m.

A note in the emissions report should call attention to this entry in the maintenance log.

The weekly summary shown in Table 3-4 indicates that the facility was at over the opacity limits frequently between 6/15 and 6/18, but was clean during the next 2 days. The source's operating log should show a series of notations that would explain these emissions. The problem might, for instance, be a malfunction of one bank of the electrostatic precipitators. If this is the case, a notation describing the failure, replacement of parts, and corrective action taken should be found in the operating log. For example:

> "6/15, 4:30 p.m. Segment 3 of ESP shorted out, metering resistor burned out, replacement ordered from G.E. Should arrive in 2 to 3 days. Operators -- try to reduce load if possible -- watch opacity and soot blowing."
>
> "06/18, 12:15 p.m. Replaced ESP resistors. Working correctly now. Opacity 12 to 13 percent."

TABLE 3-5. CALIBRATION SUMMARY REPORT

Weekly Report
06/16/75 - 06/22/75

Plant #4

	Opacity	SO_2	NO	O_2
Calibration Value	49.97	1289	1116	8.92

Sensor Readings Before Adjustment to Correct Value

Date	Time	pct	ppm	ppm	pct
06/16/77	19:46	49.7	1312	1120	8.95
06/17/77	18:10	48.1	1301	1115	8.91
06/18/77	20:17	49.0	1296	1119	8.99
06/19/77	10:21	49.9	1292	1123	8.92
06/19/77	19:45	49.1	1286	1116	8.87
06/20/77	20:46	49.8	1274	1107	8.92
06/21/77	18:31	49.3	1281	1121	8.95
06/22/77	19:20	50.1	1293	1113	8.98

Zero Summary Report

Weekly Report
06/16/77 - 06/22/77

Plant #4

Sensor Readings Before Adjustment to Zero

		Opacity	SO_2	NO	O_2
Date	Time	pct	ppm	ppm	pct
06/16/77	19:40	3.1	-10.2	-1.2	0.1
06/17/77	18:01	1.2	5.6	4.7	-0.05
06/18/77	20:07	0.6	4.3	-3.1	0.11
06/19/77	9:46	17.2*	9.2	5.2	0.03
06/19/77	19:35	1.6	4.2	10.4	0.04
06/20/77	20:40	1.0	14.1	-0.8	-0.02
06/21/77	18:20	0.9	-6.8	-2.4	0.09
06/22/77	19:09	1.3	-2.7	1.9	0.06

How to Evaluate a Report

Quarterly excess emissions data should be reported in a tabular manner:

Date	Start Time	Stop Time	Emission	Magnitude	Remarks

The remarks column should contain any notes referring to calibration checks, zero checks or the causes of excess emissions. The remaining information may be recorded only once or twice during the reporting period, but should be well documented by explanatory text. The actual format and style of such reports may vary, but all the required information must be present and understandable.

Attachments 1, 2, and 3 to this section represent three typical -- but quite different -- emissions reports. Report number 1 is essentially a negative report, since no excess emissions were found. Report number 2 properly records a few emissions and malfunctions. Report number 3 records emissions and malfunctions but is incomplete and does not meet the intent of the regulations.

The checklist shown in Table 3-6 can be used to aid evaluation of reports like those in the attachments. Below, the questions on the checklist are explained and then applied to the three sample reports.

Explanation of Checklist

1. Was the report filed?

Every owner or operator required to monitor emissions must file a written report for each calendar quarter even if no excess emissions occurred during that quarter and the monitoring system was operating correctly. In other words, a report must be filed whether it is positive or negative.

2. Was the report filed within 30 days?

All quarterly reports must be postmarked by the 30th day following the end of each calendar quarter.

TABLE 3-6. EMISSION REPORT CHECKLIST

	Yes	No
1. Was the report filed?		
2. Was the report filed within 30 days?		
3. Did it report any excess emissions?		
a. Was the time reported?		
b. Was the duration or completion time reported?		
c. Was the magnitude reported?		
4. How were excess emissions calculated?		
a. Was a conversion factor used?		
b. Does it match the standards?		
5. What percent of operating time did excess emissions represent?		
a. Less than 1%?		
b. 1 to 5%?		
c. 5 to 10%?		
d. 10% +?		
6. Did source indicate any malfunctions?		
a. Normal process equipment?		
b. Control equipment?		
c. Percent of operating time for control equipment?		
1) 1 to 5%?		
2) 5 to 10%?		
3) 10% +?		
7. Did source specify causes of malfunctions?		

TABLE 3-6. Concluded

		Yes	No
8.	Did sources specify corrective action?		
9.	Are malfunctions more frequent than last quarter/year?		
10.	Is magnitude of emissions greater than last quarter/year?		
11.	Did the source specify any downtime for the monitoring system?		
	a. 1 to 5%		
	b. 5 to 10%		
	c. 10 to 20%		
	d. 25%		
12.	Did the source indicate a cause(s) and repair(s) for such downtime?		
13.	Did the same problem recur during the monitoring period?		
14.	If no excess emissions occurred, did the source make a negative report?		
15.	If no monitoring system outages occurred, did the source make a negative report?		
16.	Is there a pattern to reported excess emissions?		
	a. A specific time of day?		
	b. A specific day of the week?		
	c. At longer intervals weekly, monthly?		

3. Did it report any excess emissions?

If the source has reported excess emissions did they also report the time, duration, and magnitude date of the excess emissions? Reports of no excess emission should be scrutinized carefully, considering past records, compliance tests, and the type of control system used.

4. How were excess emissions calculated?

For opacity, the monitor system will read directly. For power plants, the type of fuel and monitoring system will determine which F factor is used. Did the source specify sufficient information to determine which factor to use?

5. What percentage of operating time did the excess time represent?

A source that records 2 hours of excess emissions over an 8-hour period of operation may require more serious enforcement action than a source that records 2 hours of excess emissions over a 24-hour period of operation.

6. Did the source indicate any malfunctions?

Any source that achieves the emission standard during normal operation may occasionally record excess emissions due to common maintenance problems. However, the majority of excess emissions should be attributable not to normal operations but to some specific malfunction.

7. Did the source specify the cause of the malfunctions?

8. Did the source specify the corrective action?

These two items question the effectiveness of the entire emissions monitoring program. In order to have an effective pollution control program, a source must be aware of excess emissions, must find out why they occur, and must try to prevent them from occurring again. However, many sources may not have the technical staff or expertise to accomplish these goals. When that is the case, assistance from EPA personnel may be required. On the other side is the source that does not or will not investigate malfunctions beyond just returning the equipment to service by replacing parts. A good

chief engineer or plant maintenance supervisor is interested in knowing why a part fails repeatedly, because it costs him money each time he must repair the unit. There is a significant difference in taking corrective action to repair the malfunction and taking corrective action to investigate and solve the problem. Obviously, to achieve maximum pollution control, we need the problem-solving type of corrective action along with repair of malfunction.

The key things to look for in the source's report is the subjective feeling as to which of the above two categories the source belongs. If there are any similar sources in your area, compare the performance of each as regards type of control equipment, emissions, and malfunctions.

9. Are the malfunctions more frequent than last report?

10. Are the emissions greater than last report?

The evaluation of these two questions will give the first warnings of neglect of control equipment or a gradual decline in its performance. A gradual decline may indicate that more frequent maintenance is required, more highly skilled maintenance is needed, more extensive maintenance is required, or that the emission characteristics of the process may be changing and a different control technology should be applied. For example, an oil fired boiler converting to coal or a coal/oil mixture may produce greater emissions than it did when it fired oil alone.

11. Did the source specify any downtime for the monitoring system?

12. Did the source indicate the causes and repairs associated with the downtime?

Complex electromechanical monitoring systems are subject to breakdown maintenance. Downtime and repairs will vary considerably with the type of source and type of monitoring equipment. A source with particulate emissions, such as a coal fired power plant or a smelter, should expect to need to replace sample or air blower filters on their monitoring systems every few months. It would be unusual for these plants, or plants processing sulfuric acid, iron, or steel not to report some type of maintenance over a two-quarter period.

On the other hand, a nitric acid plant using a chemiluminescent or UV monitor could easily record a 180-day performance period if installed and operated correctly.

Extremes should be suspect. A source that consistently shows no maintenance, quarter after quarter, should be questioned. A source that consistently reports 15 to 20-percent or more downtime should also be questioned.

Perhaps the most important thing for the evaluator to determine is whether the source is taking its malfunction problems seriously. Whatever the reason for downtime, is the the source making efficient and timely efforts to remedy the situation?

13. Did the same problem occur again during the monitoring period?

Frequently occurring problems are <u>not</u> malfunctions, but normal operations which need improvements. If a problem keeps recurring, a prudent source operator will try to identify and correct the root cause rather than treat the symptoms of the problem. For example, instead of merely replacing source lamps in the monitor as they burn out, the prudent operator will check the wattage on the lamps and the function of the current regulator.

14. If no excess emissions occurred, did the source make a negative report?

15. If no monitoring system outages or maintenance occurred, did the source make a negative report?

The requirement for negative reports causes more inaccuracies than any other requirement. If nothing has happened in a particular category it is easy to forget to file a report. A quarterly report <u>must</u> be filed whether or not there were excess emissions. If the source operator has forgotten or is late in filing, some form of communication with the source is in order, as a reminder of his obligations.

16. Is there a pattern to reported excess emissions?

This question is asked to help gain insight into the normal operations of the source. If excess emissions periods correlate with peak load or output, the control equipment may be undersized for the application or some aspect of the emission may make the control device less effective under peak conditions. This type of information may be important if the source operates under changing conditions. For example, power plants normally operated without excess emissions, at 50 to 60-percent load, may produce excess emissions if required to operate temporarily at 90-percent of load. This kind of background information may be of significant value to the evaluator.

The primary reason for requiring a source to monitor emissions is to make the source aware of excess emissions in time to correct them. Another reason for requiring monitoring is to determine whether sources that have been in compliance continue to operate and maintain their equipment properly, so as to remain in compliance. To achieve these goals, only the magnitude and frequency of excess emissions are needed to judge if the emission control equipment is being maintained or is degrading in performance.

A properly maintained facility should show only a few randomly occuring excess emissions and the number and duration should not change significantly (50 to 100-percent increase) from quarter to quarter or month to month.

For example, a source using a baghouse might show bag replacement early in the quarter and then start to show an increasing frequency of excess emissions late in the quarter, as bags degrade and start to fail. If this trend were noticed over one, two, or more quarters, it would be in the Agency's interest to contact the source, bring these findings to his attention, and require that corrective action be taken.

Examples

Using the reports checklist, let us review the hypothetical quarterly reports presented in the attachments. Attachment 1 is a good example of a negative report. The report was filed on April 16, 1977 -- within the 30-day limit. The source stated that no excess emissions occurred. The basis of determining the limit (x lb NO_2 per ton of acid) was also stated. The report

states the extent of operations, Jan. 1, 1977 to Mar. 19, 1977, and reports no malfunctions in the identified control device. The report also indicates that the NO_x monitor operated normally. Only preventive maintenance and daily calibrations needed to be performed. The periods of outage other than for daily maintenance are clearly identified. Although the report appears to be complete, the inspector might require an explanation of the phrase "periodic maintenance." Is the maintenance being done on a regular schedule? Are further outages effectively being prevented?

The second excess emission report (Attachment 2) clearly states the date of the report, the period covered, the methods of converting the monitor readings to emissions and the conversion factor, F, for the bituminous coal burned. The report also states that both SO_2 and O_2 are measured dry. In addition, the report states that Table I contains the excess emission data and Table II contains the explanation of those emissions. However, apparently by clerical mistake, Table II is omitted. In spite of that omission, the inspector can gain the information he needs by examining the discussion of source operations.

The source also indicated a recurring PH control problem in the wet scrubber and described the investigation, identification of the cause, and the corrective action taken. The most important part of this report is not that emissions occurred, but that the causes of the excesses were identified and that positive action was taken not only to correct them in the short term, but to prevent occurrance in the long run.

In Table III, we see two short periods of outage due to equipment problems in the continuous monitoring system. The first problem, an IR source burnout, is a normal occurrence to be expected at periods of 1 to 2 years. If the source's other reports indicate replacement considerably more often, then some fundamental investigation is in order. The second outage is not unusual in wet scrubber installations, since the scrubber acts as a SO_2 and particulate control device. A scrubber restart with liquid droplet spray and wet sticky particulate will frequently clog the sample filters of monitor systems.

Although two downtime periods are indicated on the report, the reader is left to assume that the monitoring equipment was operating at all other times. No periodic or preventative maintenance is indicated.

The report is about 90 percent complete. But, because a series of 6- to 30-minute opacity excursions are not explained (perhaps this is in the missing Table II), the report is probably worth a low-key telephone call to the source asking for Table II and suggesting that a little more backup information be supplied. If the next report does not improve in these areas, a stronger phone call or letter might be in order.

The report in Attachment 3 represents a case where the source is obviously negligent and warrants much attention. To begin with, the report is late. In addition, the list of excess operating emissions is interesting in several respects. First, no explanation is given as to the source or cause of the emissions. Second, the emissions times are given in 15- or 30-minute intervals. Third, the emissions always seem to be exactly 30-percent. It appears that the source is giving minimal attention to emission monitoring. It is entirely possbile that dirty windows are not the real problem, but that the opacity monitor is malfunctioning continuously and is not able to register above 30-percent opacity. The source also does not appear to be taking any corrective action to repair its SO_2 monitor or to correct the problems in its opacity monitor. This source rates a strong letter requesting specific information and action, and probably an evaluation to follow up.

ATTACHMENT 1

Excess Emissions Report

January 1, 1977 – March 31, 1977

Nitric Acid Plant

April 16, 1977

1. Excess Emissions

During the period January 1, 1977 thru March 31, 1977, the plant was operated a total of 1824 hours with a total acid production of 22,800 tons of nitric acid. During this period our chemiluinescent NO_x monitor showed no periods of emissions in excess of the limit.

2. Source Operations

The facility was in operation on January 1, 1977 and operated for a continuous period of 76 days prior to shutdown on March 17, 1977.

There were no malfunctions in our Puraseive-N NO_x absorption system.

3. Monitoring System Operation

Our chemiluminescent NO_x monitor performed reliably during the entire time period. Periodic maintenance was performed monthly as shown below. The overall on-time monitoring time was 1796 hours or 98 percent of 1824 hours. Normal calibration checks took an average of 20 minutes/day and the two monthly periodic maintenance periods were 2 hours each.

This maintenance was performed on January 18, 1977 from 0947 to 1115 and February 21, 1976 from 1435 to 1602. Other than daily zero and span checks, no other monitor system adjustment or repair was required.

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ATTACHMENT 2

Excess Emissions Report

April 1, 1977 – June 30, 1977

XYZ Power & Light Co.

River Bend No. 2

July 19, 1977

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1. Excess Emissions

Excess emissions for the period April 1, 1977 to June 1977 are indicated by the attached printouts (Table 1) from our automatic data logger. The opacity readings are logged directly in percent opacity. The SO_2 emissions are calculated from ppm SO_2, percent oxygen, and the F factor for bituminous coal of 9820 dscf/MBtu. Both our SO_2 and O_2 analysis are made on a "dry" basis.

Emissions are calculated by the formula

$$E_{(lb/MBtu)} = C \times F \times \frac{20.9}{20.9 - O_2\%}$$

2. Source Operations

Table I, which contains the emissions data, also contains reference notes concerning startup, shutdowns and malfunctions. Table II contains detailed comments about excess emissions. The facility was down from April 7 to April 12 to replace superheater tubes and from June 1 thru June 30 for the annual repair and maintenance.

During the period from 1245 to 2310 on April 12, 1977, #6 fuel oil was burned during plant startup before switching to the normal pulverized coal. The excess opacity emissions were caused by excessive carbon deposition on cold boiler surfaces during startup and subsequent soot blowing activities. This problem would be alleviated if natural gas were available for startup but no supply is available.

There were three major process upsets in our limestone wet scrubber. On 4/3/77 loss of ph control in the scrubber liquor caused low scrubber efficiency. A recurrence on 4/5/77 caused us to suspect the pH sensor and controller. The temperature compensation circuit in the sensor was faulty and has been replaced. Since the unit had performed reliably for 2 years, we concluded that this was a random failure and have taken no major action other than replacement.

The 5/16 opacity and SO_2 upsets were caused by a liquid flow stoppage in the scrubber. A new employee opened a bypass valve by mistake. The valves have been retagged to prevent this error.

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TABLE I. EXCESS EMISSIONS

Date	Time	Duration	Emission	Magnitude	Remarks
04/02/77	1410	15 min	opacity	22.5%	
04/03/77	0806	6.5 hr	SO_2	1.8 lb/MBtu	
04/05/77	1921	3 hr	SO_2	1.6 lb/MBtu	
04/07/77	0912	30 min	opacity	36%	
04/12/77	1245	10.5 hr	opacity	25%	
04/17/77	2110	12 min	opacity	31%	
04/17/77	2240	6 min	opacity	30%	
04/17/77	2310	6 min	opacity	26%	
05/16/77	0311	48 min	opacity	29%	
05/16/77	0311	3 min	SO_2	1.8 lb/MBtu	
05/18/77	1739	6 min	opacity	22%	

3. Monitoring System Operation

Table III indicates the operational/nonoperational periods for our monitoring system.

TABLE III

Date	Time	Problem/Corrective Action
April 21, 1977	4:15 pm to 5:45 pm	IR source lamp on CO_2 monitor burned out. Replaced from stock, checked voltage. System back on line at 5:45 pm, recalibrated
May 16, 1977	4:00 am to 10:15 am	Night shift operator noticed peculiar behavior of monitor after scrubber restart. First shift maintenance replaced clogged fitter which was wet and sticky. Unit recalibrated and appears okay.

ATTACHMENT 3

Quarterly Report

April 1977 – June 1977

August 14, 1977

PDQ Smelting Company

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1. Excess Emissions

The excess emissions report for our lead smelter is tabulated below:

Date		Time	Emission	Magnitude
April	2	2:30 - 4:15	opacity	25%
	3	9:30 - 10:30	opacity	30%
	5	12:30 - 2:30	opacity	30%
	6	4:00 - 4:30	opacity	30%
	10	8:30 - 9:00	opacity	30%
	11	10:00 - 11:00	opacity	30%
	27	1:00 - 2:00	opacity	30%
	28	1:30 - 2:00	opacity	30%
	29	1:30 - 2:00	opacity	30%
	30	3:00 - 3:30	opacity	30%
May	1	11:30 - 3:00	opacity	30%
	2	12:00 - 2:00	opacity	30%
	3	2:00 - 3:00	opacity	30%
	5	3:00 6:00	opacity	30%
	6	9:00 - 12:00	opacity	30%
	7	8:00 - 9:00	opacity	30%
	8	12:00 - 1:00	opacity	30%
	16	4:00 - 6:00	opacity	30%
	17	3:00 - 3:30	opacity	30%
	18	1:30 - 2:30	opacity	30%
	19	8:30 - 10:00	opacity	30%
	20	1:00 - 1:30	opacity	30%
June	7	7:00 - 9:30	opacity	30%
	8	2:00 - 2:30	opacity	30%
	9	12:30 - 1:00	opacity	30%
	23	2:00 - 2:30	opacity	30%
	24	3:00 - 4:30	opacity	30%
	25	10:00 - 10:30	opacity	30%
	26	12:00 - 4:30	opacity	30%

2. Monitoring System

The SO_2 monitoring system was inoperative from April 1977 until June 1977 because we could not get replacement light sources from our local supplier.

The opacity monitor was inoperative from April 11 to 27, May 8 to 16, May 20 to June 7, and June 26 to June 30 because windows got dirty too rapidly. The vendor made a poor installation.

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